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Mr. Gary Miller, Remedial Project Manager
United States Environmental Protection Agency (EPA), Region 6 (6SF-RA)
1445 Ross Avenue
Dallas, TX 75202-2733

Re: San Jacinto River Waste Pits Superfund Site – Supplemental Comments on Proposed Remedial Action Plan

Dear Mr. Miller:

Please note that I mailed a similar letter to you yesterday. Please subsitute this version for the one sent to you yesterday.

I am a civil engineer with expertise in water resources and river engineering and 40 years experience. My resume is enclosed. Late last year I was asked to review certain assertions made in the Proposed Remedial Action Plan (PRAP) for the San Jacinto Waste Pits EPA Superfund Site dealing with the long term stability of the site in the face of fluvial and coastal processes. My response to that request was completed on or about 10 January 2017 and submitted as part of comments of McGinnes Industrial Maintenance Corporation and International Paper Company on the PRAP (January Report); it is also provided as an enclosure to this letter. More recently I was asked to re-examine my findings in light of new information and experience generated by the passage of Hurricane Harvey. I am writing to provide as part of the record my comments to date and I will later submit a more complete supplemental report.

I visited the site and its environs on 21 September 2017, examined site monitoring data collected since the storm, satellite and aerial photos taken before, during and after the event, and output from a computer model that simulated water depths and current velocities over and adjacent to the Northern Impoundment during the event. My findings are summarized below.

Despite the damage produced by Hurricane Harvey, its passage creates an unusual opportunity to test assertions regarding long term site stability of the armored cap in the face of extreme hydrologic events and stresses. Since the storm stalled over Texas for several days, rainfall totals were unprecedented. High flow durations and magnitudes were extreme, and the relatively low level of storm surge produced higher hydraulic gradients than for storms with significant surge. Initial posts from NOAA (https://www.climate.gov/news-features/event-tracker/reviewing-hurricane-harveys-catastrophic-rain-and-flooding, accessed 2017.09.27) regarding the magnitude of the rainfall event indicate it exceeded the 500 year event. "Houston observed two of its wettest five days ever on back to back days August 26 and 27." About 24 inches of rain fell in two days at Houston Hobby Airport. A total of 43.38 inches of rain were reported for Houston Furthermore,

> ... an official analysis of whether rainfall amounts in Harvey were a 1-in-500-year event or 1-in-1000 will have to wait for the time being. However, Dr. Sanja Perica, chief of the National Weather Service's Hydrometeorological Design Studies Center, has noted that preliminary

estimates for the area suggest that some locations likely received rainfall amounts that have a 0.1 (one in a thousand) percent chance of occurring in any year.

Analysis from other groups also came to similar conclusion. As noted by the Washington Post, in an analysis of the highest one-day rainfall amounts done by Shane Hubbard of the University of Wisconsin, such a large amount of rain falling over a one-day period has a 0 1% chance of occurring in any given year. Analysis of the five-day rainfall amounts by the company MetSat found that five-day rainfall totals on par with Harvey's had a 0.004% to 0.0002% chance of occurring in any given year.

A stage hydrograph collected by the USGS at the I-10 bridge which is immediately south of the existing armored cap at the site indicated that passage of the storm produced peak stages 12 ft above base flow. In the PRAP, EPA asserted that a sequence of historical aerial photographs showed that the reach of the San Jacinto River containing the site was, "a very dynamic system." The channel and riparian changes shown in the referenced photos were almost entirely due to land subsidence related to groundwater extraction and sand mining (dredging). As noted in my January report, land subsidence in this area is no longer occurring, and sand mining is now limited by institutional controls.

Despite the passage of the flows associated with Harvey, my visual inspection of the river and examination of satellite imagery covering the entire reach from Lake Houston Dam to the mouth of Buffalo Bayou indicates that there were no permanent avulsions associated with the event. I did observe erosion and deposition associated with overbank flows in the same locations (Rio Villa in Banana Bend oxbow and Highland Shores in Banana Bend) as for the 1994 flood described in my January Report. Further, there was erosion associated with overbank flow about 1.25 miles due east of the capped portion of the Site. However, by the time I visited the site, the river had returned to its pre-flood alignment. As in 1994, eroded overbank channels did not capture river baseflow, and the river returned to its pre-flood channel as the flood receded. Alignment of concave banks outside of bends were stable. Examination of pre- and post-flood satellite imagery did depict bank erosion at three locations between the Lake Houston Dam and the Muleshoe Lake, which is about 4.3 miles (straight line distance) upstream from the existing TCRA cap. Fresh sediment deposits were more common, both along the channel margins, in the form of mid-channel bars, and in overbank areas subjected to flow.

The PRAP also states that, "The San Jacinto River is a very dynamic system, subject to changes in size and flow paths as experienced during the 1994 storm." Examination of pre- and post-flood satellite imagery from dates with similar water surface elevations (20 August and 19 September 2017, www.planet.com) indicates no changes in alignment of the San Jacinto River. Channel width changes were limited to a reach extending about 0.6 miles up- and downstream of the US Hwy 90 bridge, about 5.2 miles northwest of the existing TCRA cap.

The PRAP also notes that, "Sonar tests in a 130-foot section south of the I-10 Bridge located adjacent to the Site found about 10 to 12-feet of erosion from the bottom of the river bed." I have no information regarding bridge scour associated with Harvey. However, post-flood bathymetric surveys revealed 5-12 ft of scour along the eastern side of the Northern Impoundment, and about 195 sq. ft or 0.03% of area of the armored cap required maintenance. No impacts on the Southern Impoundment were noted.

Despite the severe test of the Time Critical Removal Action (TCRA) measures and the extent of this scour, the integrity of the existing TCRA cap itself was not compromised. Furthermore, during a Spring 2016 high flow event, a similar but smaller scour zone developed immediately north of this one and was remediated using placement of geotextile and riprap. The 2016 maintenance was not disturbed by the Harvey event, showing the efficacy of these standard engineering measures (i e., thickened toe, gradual slopes, adequate size and quality stone riprap, well designed and placed geotextile) to protect a future enhanced cap at the site.

The PRAP asserts that, "These changes (i.e., loss of land at the waste pits site due to erosion and subsidence) will likely continue in the future." My examination of evidence available since Harvey yields no change in my earlier response to this assertion regarding changes due to land subsidence. However, the passage of Harvey represents a historical worst case with regard to floodplain erosion. Examination of the aforementioned pre- and postflood satellite imagery did not reveal any land loss in the vicinity of the Northern Impoundment or the Southern Impoundment or in the river reach containing the site. Furthermore, 2D hydrodynamic computer modeling results produced by Anchor QEA in order to hindcast the peak Harvey storm hydraulic stresses on the TCRA cap indicated that Harvey produced velocities over the TCRA cap that approached but did not exceed those used in the TCRA design (6.9 ft/s simulated vs. 8.5 ft/s used in design). Consistent with these results, storm damage to the TCRA cap was minor, limited to extremely small areas, and occurred in areas in which smaller materials were called for as part of the TCRA cap design. If the temporary TCRA cap, constructed using smaller materials and with less robust design withstood the Harvey event, then a well-engineered permanent treatment (such as the one proposed by the USACE in the PRAP) should provide adequate protection from future fluvial and coastal processes.

The PRAP asserted that computer models have limited utility in predicting future erosion and river channel changes. While I have no new information to add to my previous response on this point, I note that the actual data and observations produced by the Harvey event are more valuable than computer simulations. Site integrity in the face of this event, as noted above, should produce greater confidence in well-designed solutions for stabilization in place.

Finally, the PRAP noted that, "Future storm intensity and flooding may be even more intense due to climate change, sea level rise, and continued urban development." The only amendment needed to my original reponse to this point is that even under a future climatic regime, the precipitation event associated with Harvey will be a rare, extreme event and therefore provides an indication of how a well-designed and constructed cap and associated perimeter protection would fare in future storms. In addition, future fluvial and coastal processes may be ameliorated by future sea level rise and natural sediment deposition as noted in my previous report.

If I can provide further details or discussion regarding these comments, please do not hesitate to contact me at 662.380.3944 or doug2shields@gmail.com.

Sincerely,

F. Douglas Shields Jr.

F. Douglas Shields, Jr. Ph.D., P.E., D.WRE

Enclosures

CF (via email)
The Honorable Scott Pruitt, EPA Administrator
Albert Kelly
James Woolford
Dana Stalcup
Sam Coleman